# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

# BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: MURPHY, Robert H. et al. | Group Art Unit: 2622

Serial No. 10/521,031 | Examiner: NGUYEN, L. T.

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For: FRONT LENS SHUTTER MOUNT FOR UNIFORMITY CORRECTION

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## APPEAL BRIEF

This Appeal Brief under 37 C.F.R. §1.192 is submitted in support of the Notice of Appeal filed July 20, 2010, appealing to the Board from the action of the Patent Examiner's Final Office Action, mailed April 28, 2010, finally rejecting pending claims 1-4, 8-13, 15, 16 and 21-24 of the above reference application.

DEPOSIT ACCOUNT **190130** AUTHORIZATION – All necessary fees are intended to be included, however the Office is hereby authorized to charge any deficiency or credit any overpayment in the fees to the above deposit account, owned by BAE SYSTEMS Information and Electronic Systems Integration Inc. an authorized signator for which is Kevin M. Perkins, V.P. & Company Counsel, and for whom the undersigned are authorized agents.

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## REAL PARTY IN INTEREST

The present application is assigned to BAE Systems, the real party of interest.

## RELATED APPEALS AND INTERFERENCES

No related appeal is presently pending.

## STATUS OF THE CLAIMS

Claims 5-7, 14, and 17-20 have been cancelled. Claims 1-4, 8-13, 15, 16 and 21-24, which were finally rejected by the Examiner as noted in the Final Office Action dated April 28, 2010, are being appealed.

## STATUS OF AMENDMENTS

A Response was submitted on August 5, 2005 in reply to a non-final Office Action dated February 5, 2008. A Response was submitted on February 9, 2009 in response to a Final Office Action dated December 2, 2008. A Response was submitted April 24, 2009 in response to a non-Final Office Action dated March 17, 2009. A Response was submitted on September 17, 2009 in response to a Final Office Action dated July 21, 2009. A Response was submitted on January 27, 2010 in response to a non-Final Office Action dated October 27, 2009. No amendments have been submitted subsequent to the Final office action of April 28, 2010.

## SUMMARY OF THE CLAIMED SUBJECT MATTER

Claim 1 recites a thermal imaging based system adapted for imaging infra-red radiation that is emitted by a black body. According to claim 1, the thermal imaging based system includes a focal plane array (FPA) (Paragraph [0012] and item **125** of Figure 1) having a plurality of pixels sensitive to infra-red radiation. The thermal imaging system further includes a lens disposed between the black body and the FPA (paragraph [0012] and item **120** between items **105** and **125** in Figure 1**)** and adapted to focus the infra-red radiation emitted by the black body in front of the lens onto the FPA behind the lens (paragraph [0012]). The plurality of pixels of the FPA have sufficient

infra-red sensitivity to detect the infra-red radiation emitted by the black body (Paragraph [0012] and item **125** of Figure 1).

The plurality of pixels of the FPA also have sufficient infra-red sensitivity to detect infra-red radiation emitted by the lens. The specification clearly discloses that the FPA can detect the internal flux. See for example paragraph [0015] which recites "generating a closed state image signal that includes **internal radiant flux** of the system." The term "internal flux" is well known in the art to refer to black body infrared radiation given off by elements which are internal to the imaging system. This meaning of the term "internal flux" is also clear from the many references to internal flux throughout the specification (paragraphs [0010], [0012], [0015], [0017],[0028], [0029], [0036], and [0040]). The lens is specifically indicated as being an internal element of the imaging system, e.g. in paragraph [0012] and item **120** in Figure 1. Therefore, the infra-red radiation emitted by the lens is necessarily included in the internal flux, and paragraph [0015] and similar references in the specification which support detection by the FPA of the internal flux implicitly and necessarily provide support for the FPA being able to detect infrared radiation emitted by the lens.

According to claim 1, the imaging system further includes a shutter located between the lens and the black body (Paragraph [0012], and item **110** between items **120** and **105** in Figure 1), the shutter having a closed state and an open state, wherein the closed state prevents the infra-red radiation emitted by the black body from reaching the FPA while allowing the infra-red radiation emitted by the lens to by detected by the FPA as a reference image signal, and the open state allows both the infra-red radiation emitted by the black body and the infra-red radiation emitted by the lens to be detected by the FPA as an open state image signal (paragraph [0012]). According to claim 1, the imaging system also includes a signal processing module operatively coupled to the FPA, and adapted to correct the open state image signal based on the reference image signal (paragraph 12, and item **130** in Figure 1).

Claim 10 recites a method for thermally imaging a black body. The method includes providing a thermal imaging based system configured with a lens (paragraph

[0012] and item **120** between items **105** and **125** in Figure 1**)**; a focal plane array (FPA) (Paragraph [0012] and item **125** of Figure 1), the FPA having sufficient infra-red sensitivity so as to detect infra-red radiation emitted by the black body (Paragraph [0012] and item **125** of Figure 1).

The FPA also has sufficient infra-red sensitivity to detect infra-red radiation emitted by the lens. The specification clearly discloses that the FPA can detect the internal flux. See for example paragraph [0015] which recites "generating a closed state image signal that includes **internal radiant flux** of the system." The term "internal flux" is well known in the art to refer to black body infrared radiation given off by elements which are internal to the imaging system. This meaning of the term "internal flux" is also clear from the many references to internal flux throughout the specification (paragraphs [0010], [0012], [0015], [0017],[0028], [0029], [0036], and [0040]). The lens is specifically indicated as being an internal element of the imaging system, e.g. in paragraph [0012] and item **120** in Figure 1. Therefore, the infra-red radiation emitted by the lens is necessarily included in the internal flux, and paragraph [0015] and similar references in the specification which support detection by the FPA of the internal flux implicitly and necessarily provide support for the FPA being able to detect infrared radiation emitted by the lens.

According to claim 10, the imaging system also a shutter, the shutter being disposed between the lens and the black body (Paragraph [0012], and **110** between **120** and **105** in Figure 1). The method according to claim 10 further includes closing the shutter so that the infra-red radiation emitted by the black body is blocked from reaching the FPA (paragraph [0036] and item **205** of Figure 2), generating a closed state image signal that includes the infra-red radiation emitted by the lens (paragraph [0036] and item **210** of Figure 2, see comments above regarding the lens being a source of internal flux), opening the shutter, thereby allowing the infra-red radiation emitted by the black body to reach the FPA (paragraph [0037] and item **215** of Figure 2), generating an open state image signal that includes both the infra-red radiation emitted by the black body and the infra-red radiation emitted by the lens (paragraph [0037] and

item **220** of Figure 2), and correcting the open state image signal based on the closed state image signal (paragraph [0039] and item **225** of Figure 2).

Claim 15 recites a method for manufacturing an imaging system adapted for imaging infra-red radiation emitted by a black body. The method includes

providing a thermal imaging based system comprising a lens (paragraph [0012] and item **120** between items **105** and **125** in Figure 1**)** and a thermal imaging detector array (Paragraph [0012] and item **125** of Figure 1), the lens being adapted to focus infra-red radiation emitted by the black body onto the thermal imaging detector array (paragraph [0012], the thermal imaging detector array having sufficient sensitivity to detect the infra-red radiation emitted by the black body (Paragraph [0012] and item **125** of Figure 1).

The thermal imaging detector array also has sufficient infra-red sensitivity to detect infra-red radiation emitted by the lens. The specification clearly discloses that the FPA can detect the internal flux. See for example paragraph [0015] which recites "generating a closed state image signal that includes **internal radiant flux** of the system." The term "internal flux" is well known in the art to refer to black body infrared radiation given off by elements which are internal to the imaging system. This meaning of the term "internal flux" is also clear from the many references to internal flux throughout the specification (paragraphs [0010], [0012], [0015], [0017],[0028], [0029], [0036], and [0040]). The lens is specifically indicated as being an internal element of the imaging system, e.g. in paragraph [0012] and item **120** in Figure 1. Therefore, the infra-red radiation emitted by the lens is necessarily included in the internal flux, and paragraph [0015] and similar references in the specification which support detection by the FPA of the internal flux implicitly and necessarily provide support for the FPA being able to detect infrared radiation emitted by the lens.

According to claim 15, the method further includes providing a shutter located between the black body and the lens (Paragraph [0012], and item **110** between items **120** and **105** in Figure 1), the shutter having a closed state that prevents the infra-red radiation emitted by the black body from reaching the lens while allowing the thermal

imaging detector array to generate a closed state image signal comprising the infra-red radiation emitted by the lens, and an open state that allows the detector array to generate an open state image signal comprising both the infra-red radiation emitted by the lens and the infra-red radiation emitted by the black body (paragraph [0012]).

Claim 23 is dependent upon claim 1, and adds the further limitation that the shutter has a lens side surface that is located within five millimeters of the front side of the lens (paragraph [0014]).

Claim 24 is dependent upon claim 1, and adds the further limitation that the shutter has a lens side surface that is located within one millimeter of the front side of the lens (paragraph [0019]).

## GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. The Examiner's rejection of claims 1-4, 8-13, 15-16, 21-22, 23-24 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

2. The Examiner's rejection of claims 1-4, 8-13, 15-16, 21-22 under 35 U.S.C. 103(a) as being unpatentable over Lindgren et al. US (5,420,421) in view of Medina (US 5,081,530) further in view of Bakhle et al. (US 6,061,092).

3. The Examiner's rejection of claims 23 and 24 under 35 U.S.C. 103(a) as being unpatentable over Lindgren et al. US (5,420,421) in view of Medina (US 5,081,530) and Bakhle et al. (US 6,061,092) further in view of Sato (US 6,181,484).

## ARGUMENT

The Examiner's rejections of claims 1-4, 8-13, 15, 16 and 21-24 are not well-founded and should be reversed.

### 1. Rejection of Claims 1-4, 8-13, 15-16, 21-22, and 23-24 under 35 U.S.C. 112

Claims 1-4, 8-13, 15-16, 21-22, and 23-24 comply with the written description requirement and are patentable under 35 U.S.C. 112.

In the office action of April 28, 2010, the Examiner rejected independent claims 1, 10, and 15, and all claims dependent thereupon, stating that the specification does not support the limitation that the FPA ("thermal imaging detector array" in claim 15) is able to detect infra-red radiation emitted by the lens.

The specification clearly discloses that the FPA can detect the internal flux. See for example paragraph [0015] which recites "generating a closed state image signal that includes **internal radiant flux** of the system."

The term "internal flux" is a term of art that is well known to refer to black body infrared radiation given off by elements which are internal to the thermal imaging system, such as the lens and shutter. Note the following statement from page 2 of the 37 CFR 1.132 declaration included in the Evidence Appendix of this brief:

"It was common at that time for thermal imaging systems to be cryogenically cooled so as to suppress the **internal flux** of black body infra-red radiation emitted by components of the imaging system. The shutter was used mainly to provide calibration images that would correct for temperature variations, non-linearities, and other imperfections in the FPA itself, without regard to **infra-red emissions by the lens**, shutter, or other system components."

This meaning of the term "internal flux" is also clear from the many references to internal flux throughout the specification (paragraphs [0010], [0012], [0015], [0017], [0028], [0029], [0036], and [0040]).

The lens is specifically indicated in the specification as being an internal element of the imaging system, e.g. in paragraph [0012] and item **120** in Figure 1. Therefore, the infra-red radiation emitted by the lens is necessarily included in the internal flux, and paragraph [0015] and similar references in the specification which support detection by the FPA of the internal flux implicitly and necessarily provide support for the limitations in claims 1, 10, and 15 that the FPA ("thermal imaging detector array" in claim 15) is able to detect infrared radiation emitted by the lens.

Claims 2-4, 8, 9, and 23-24 are dependent on claim 1, claims 11-13 are dependent on claim 15, and claims 16, and 21-22 are dependent on claim 15. These claims do not

include explicit limitations regarding detection by the FPA of infrared radiation emitted by the lens, but were rejected solely due to their dependence on independent claims 1, 10, and 15. Since independent claims 1, 10, and 15 find support in the specification, as discussed above, dependent claims 2-4, 8, 9, and 23-24 also find support in the specification.

**2. Rejection of claims 1-4, 8-13, 15-16, 21-22 under 35 U.S.C. 103(a) as being unpatentable over Lindgren et al. US (5,420,421) in view of Medina (US 5,081,530) further in view of Bakhle et al. (US 6,061,092).**

*A. Failure of the combined references to teach all of the limitations of the rejected claims*

All of the claims of the present application which are appealed herein require that the FPA ("thermal imaging detector array" in claim 15) be capable of detecting infra-red radiation emitted by the lens when the shutter is closed. This limitation necessarily requires two features. First, the shutter must be positioned such that infra-red radiation emitted by the lens is able to reach the FPA when the shutter is closed. Second, the detector (i.e. FPA or equivalent) must have sufficient sensitivity to detect the infra-red radiation emitted by the lens.

Neither Lindgren, Medina, nor Bakhle teaches that the FPA ("thermal imaging detector array" in claim 15) is capable of detecting infra-red radiation emitted by the lens when the shutter is closed. Lindgren is directed to a thermal imaging system which may have sufficient sensitivity to detect infra-red radiation emitted by the lens. However, no shutter is taught by Lindgren. Media and Bakhle are both directed to systems which detect reflected light, and so they necessarily lack the required detector sensitivity to detect infra-red radiation emitted by the lens, whether or not the shutter is closed, and no matter where the shutter is located.

Since no cited prior art reference teaches the limitation that the system is capable of detecting infra-red radiation emitted by the lens when the shutter is closed, no combination of the teachings of these references can teach this limitation. Therefore, no combination of Lindgren with Medina and Bakhle can provide all of the limitations of independent claims 1, 10, and 15, and so claims 1, 10, and 15, and claims dependent thereupon, cannot be obvious in light of any combination of Lindgren, Medina, and Bakhle.

*B. Improper combination of incompatible references under 35 USC 103(a) using hindsight*

Arguing in the alternative, the Examiner's rejection under 35 USC 103(a) depends on asserting a combination of art directed to a thermal imaging system (Lindgren), with art directed to systems which image reflected light (Medina and Bakhle). Appellant asserts that these references are incompatible, and that such a combination of incompatible arts is improper and depends on hindsight.

The office in this prosecution has failed in six separate office actions and two Examiner interviews to produce one single prior art reference directed to a thermal imaging system, (i.e. a system capable of imaging an infra-red black body scene), which broke with the conventional wisdom and placed the shutter between the scene and the lens, and not between the lens and the FPA. Instead, the office has persisted in rejecting the claims of the present invention based on improper combinations of conventional thermal imaging systems (with shutters between the lens and the FPA) and reflected light cameras which image energy reflected from illuminated scenes.

While it may be tempting to assume that reflected light cameras are a closely related art to black body thermal imaging systems, this is not the case. The central problem addressed by the present invention is image distortion due to internal infra-red flux. This problem does not occur in reflected light cameras, because the reflected light which is imaged by such cameras is more intense by orders of magnitude than the internal flux. This fact is well known to those of average skill in the art of black body thermal imaging systems. Therefore, someone of average skill in the art of black body thermal imaging systems would have had no motivation to turn to the art of reflected light cameras so as to discover sources of image distortion and/or methods for eliminating distortions due to internal flux.

Even if someone of average skill had turned to the art of reflected light cameras, he or she would not have found any teachings about internal flux in that art. Prior art references directed to reflected light imaging systems, such as Medina, are more or less indifferent as to where the shutter is located relative to the lens. In fact, Medina is explicitly not concerned about where the shutter is located, because he is not concerned about internal flux. See Medina column 3, lines 66-68: "Shutter 24 is depicted in front of the lens 25, but could be placed behind it, or could be an integral part of the sensor 26."

In light of the accepted wisdom in the art of thermal imaging systems to place the shutter between the lens and the FPA, Medina actually teaches away from locating the shutter between the lens and the scene, because Medina explicitly indicates that the placement of the shutter is arbitrary, thereby explicitly giving no reason to break with the accepted wisdom.

One of average skill reading Medina would therefore have concluded that the location of the shutter was irrelevant, and would have found no motive to combine Medina with Lundgren for a solution to image distortion caused by internal flux in a thermal imaging system, especially when such a combination was contrary to conventional wisdom.

Bakhle is directed to a video camera which detects reflected visible light, and so Bakhle is also directed to an art which is unrelated to the art of this invention, and which makes no suggestions as to how to address distortions in thermal imaging systems caused by internal flux.

Appellant takes note of the decision in In re Kahn (Fed. Cir. 2006, 04–1616) which recites in part: "....[T]o establish a prima facie case of obviousness based on a combination of elements disclosed in the prior art, the Board must articulate the basis on which it concludes that it would have been obvious to make the claimed invention. [Rouffett, 149 F.3d at 1355] In practice, this requires that the Board "**explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious.**" Id. at 1357-59. This entails consideration of both the "scope and content of the prior art" and "level of ordinary skill in the pertinent art" aspects of the Graham test. When the Board does not explain the motivation, or the suggestion or teaching, that would have led the skilled artisan at the time of the invention to the claimed combination as a whole, **we infer that the Board used hindsight** to conclude that the invention was obvious."

Appellant therefore asserts that the combination of Lindgren with Medina and Bakhle requires the application of hindsight, and that the examiner has failed to establish a prima fascia case of obviousness.

*C. Evidence of non-obviousness: discovery of the source of a problem*

Continuing to argue in the alternative, appellant further asserts that even if a prima-facia case of obviousness were somehow to be established, claims 1, 10, and 15

cannot be obvious because the present invention is a patentable invention which lies at least in part in the discovery of the source of a problem, as per MPEP 2141.02, subsection III and In re Sponnoble, 405 F.2d 578, 585, 160 USPQ 237, 243 (CCPA 1969), which recites in part: "**[A] patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified.** This is part of the 'subject matter as a whole' which should always be considered in determining the obviousness of an invention under 35 U.S.C. § 103."

It is known in the art of thermal imaging systems to obtain a “closed shutter” image as a reference image, and then to use this reference image to correct thermal images of black body scenes for non-linearities and/or other imperfections of the FPA (or other detector). However, this approach does not eliminate image distortions due to internal flux if the shutter is located between the lens and the FPA, which was the accepted wisdom and unquestioned practice until the present invention.

Until the present invention, it was not understood in the art that internal flux was a significant source of thermal image distortion. This is supported by the declaration under 37 CFR 1.132 included in the Evidence Appendix of this brief. Therefore, even if the solution of placing the lens between the shutter and the FPA were to be considered obvious in light of a clear understanding of the problem to be solved, the present invention nevertheless remains a patentable invention due to the inventor’s discovery that internal flux effects was a source of thermal imaging distortion.

*D. Evidence of non-obviousness: proceeding contrary to accepted wisdom*

Continuing to argue in the alternative, appellant further asserts that even if a prima-facia case of obviousness were somehow to be established, claims 1, 10, and 15 cannot be obvious because the inventors “proceeded contrary to accepted wisdom” as per MPEP 2145, subsection 3. See, e.g., Beattie, 974 F.2d at 1313, 24 USPQ2d at 1042-43 (Seven declarations provided by music teachers opining that the art teaches away from the claimed invention must be considered). See also In re Hedges, 783 F.2d 1038, 228 USPQ 685 (Fed. Cir. 1986) (Appellant's claimed process for sulfonating diphenyl sulfone at a temperature above 127°C was contrary to accepted wisdom because the prior art as a whole suggested using lower temperatures for optimum results as evidenced by charring, decomposition, or reduced yields at higher temperatures.). See in addition United States v. Adams, 383 U.S. 39, 52, 148 USPQ 479, 484 (1966), which

recites in part "[k]nown disadvantages in old devices which would naturally discourage search for new inventions may be taken into account in determining obviousness.".

The affidavit according to 17 CFR 1.132 which is included in the Evidence Appendix submitted herewith presents evidence that the accepted wisdom in the art at the time of the invention placed the shutter between the lens and the FPA, and that the significance of the internal flux, including the infra-red radiation emitted by the lens, was not understood as a source of background noise at that time in the art.

The present invention was conceived under circumstances which are strikingly similar to the scenarios described in the case law cited above. The accepted wisdom in the art of thermal imaging systems at the time of the invention was to place the shutter adjacent to the FPA (i.e. between the lens and the FPA). This was for several practical reasons. Thermal imaging systems at that time were commonly cryogenically cooled, and the lens was optically confined within the cooling envelope. Therefore, infra-red black body radiation emitted by the lens was minimal, and the shutter was used mainly to provide calibration imagines that would correct for non-linearities and imperfections in the FPA itself. There was room between the lens and the FPA for the shutter, and placement of the shutter there kept the shutter relatively small. Therefore, the conventional configuration of placing the shutter between the lens and the FPA made sense at the time, and any departure from this conventional wisdom would have involved known disadvantages which would naturally discourage searching for new inventions which departed from this accepted wisdom.

When digital image correction became more sophisticated due to advances in computing technology, and as improvements were made in detector technology, it was found that cryogenic cooling of the lens was no longer necessary under all circumstances. However, it remained the accepted wisdom in the art to place the shutter between the lens and the FPA. It was not recognized at that time by those of ordinary skill that internal flux, including infra-red radiation emitted by the lens, was a source of thermal image distortion in uncooled systems.

The present invention was enabled by the discovery of the inventors that internal flux, including infra-red radiation emitted by the lens, was a source of background noise in some thermal imaging systems, and the consequent impetus to proceed against the accepted wisdom of the art and place the shutter between the lens and the scene, rather than between the lens and the FPA.

**3. Rejection of claims 23 and 24 under 35 U.S.C. 103(a) as being unpatentable over Lindgren et al. US (5,420,421) in view of Medina (US 5,081,530) and Bakhle et al. (US 6,061,092) further in view of Sato (US 6,181,484).**

In the final office action of April 28, 2010, claims 23 and 24 are rejected under 35 USC 103(a) due to combination of Lindren, Medina, and Bakhle, as discussed above, and further in view of Sato. In particular, the teaching of Sato in column 4, lines 48-51 is cited: "Here, the shutter **2** is disposed at a position which is distanced from the image-side surface of the second lens L2 by 1.97 mm toward the image side."

According to the arguments presented above, Appellant asserts that Claim 1 is not obvious due to any combination of Lindgren, Medina, and Bakhle. Sato adds no teachings which would address the arguments presented above. Therefore, since claims 23 and 24 depend on claim 1, claims 23 and 24 cannot be obvious in light of Lindgren, Medina, Bakhle, and Sato.

Arguing in the alternative, Sato also fails to teach the limitation of claim 23 that the shutter has a lens side surface that is located within five millimeters of a front side of the lens. In addition, Sato fails to teach the limitation of claim 24 that the shutter has a lens side surface that is located within one millimeters of a front side of the lens.

With reference to Figure 1 of Sato, the shutter **2** is located between the imaging plane **1** (where the FPA would be located in the present invention) and lens **L2.** As stated in the cited lines from Sato, the distance 1.97mm refers to a distance between the shutter **2** and the **image side** of the lens L2, in other words the side of L2 which is closest to the plane **1** where the image is formed.

Claims 23 and 24 provide limitations as to the distance between the shutter and the "front" of the lens. With reference to Figure 1 of the present application, it is clear that the front of the lens **120** is the side of the lens **120** which faces the black body scene **110**, NOT the side of the lens **120** which faces the FPA **125**. .

Sato provides no teachings regarding a distance ("d" in Figure 1 of the present application) between the shutter and a "front" of a lens which faces the scene to be imaged. This is an important distinction, since it is fundamental to the present invention that the shutter is located between the scene and the lens, and not between the lens and the FPA.

In addition, arguing in the alternative with regard to claim 24, 1.97 millimeters is larger than one millimeter. Therefore, Sato is silent regarding placement of the shutter within one millimeter of the lens.

## CONCLUSION

For the reasons stated above, Appellant believes that the claimed invention to be patentably distinct over the cited references, and that the rejections under 35 U.S.C. § 103(a) are not well-founded. Hence, Appellant respectfully urges the Board to reverse the Examiner's rejections.

Respectfully submitted,

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## CLAIMS APPENDIX

1. A thermal imaging based system adapted for imaging infra-red radiation that is emitted by a black body, the thermal imaging based system comprising:

a focal plane array (FPA) having a plurality of pixels sensitive to infra-red radiation;

a lens disposed between the black body and the FPA and adapted to focus the infra-red radiation emitted by the black body in front of the lens onto the FPA behind the lens, the plurality of pixels of the FPA having sufficient infra-red sensitivity so as to detect the infra-red radiation emitted by the black body as well as infra-red radiation emitted by the lens;

a shutter located between the lens and the black body, the shutter having a closed state and an open state wherein the closed state prevents the infra-red radiation emitted by the black body from reaching the FPA while allowing the infra-red radiation emitted by the lens to by detected by the FPA as a reference image signal, and the open state allows both the infra-red radiation emitted by the black body and the infra-red radiation emitted by the lens to be detected by the FPA as an open state image signal; and

a signal processing module operatively coupled to the FPA, and adapted to correct the open state image signal based on the reference image signal.

2. The system of claim 1 further comprising:

a shutter controller operatively coupled to the shutter, and adapted to command the shutter to its opened and closed states.

3. The system of claim 2 further comprising:

a system controller communicatively coupled to the shutter controller and the signal processing module, and adapted to control operation of the imaging system.

4. The system of claim 3 where the system controller is communicatively coupled to a network thereby enabling the imaging system to communicate with other systems also communicatively coupled to the network.

5 - 7. (Canceled)

8. The system of claim 1 wherein for any one session of imaging system operation, each of a plurality of open state image signals are corrected for pixel-to-pixel non-uniformities and offset based on the open and closed state image signals.

9. The system of claim 1 wherein the closed state image signal is periodically generated to account for changes in the imaging system.

10. A method for thermally imaging a black body, comprising:

providing a thermal imaging based system configured with a lens; a focal plane array (FPA), the FPA having sufficient infra-red sensitivity so as to detect infra-red radiation emitted by the black body as well as infra-red radiation emitted by the lens; and a shutter, the shutter being disposed between the lens and the black body;

closing the shutter so that the infra-red radiation emitted by the black body is blocked from reaching the FPA;

generating a closed state image signal that includes the infra-red radiation emitted by the lens;

opening the shutter, thereby allowing the infra-red radiation emitted by the black body to reach the FPA;

generating an open state image signal that includes both the infra-red radiation emitted by the black body and the infra-red radiation emitted by the lens; and

correcting the open state image signal based on the closed state image signal.

11. The method of claim 10 wherein correcting the open state image signal includes compensating for pixel-to-pixel non-uniformities of the FPA.

12. The method of claim 10 wherein correcting the open state image signal includes compensating for offsets between the opened and closed states of the shutter.

13. The method of claim 10 wherein correcting the open state image signal includes compensating for pixel-to-pixel non-uniformities and offsets between the opened and closed states of the shutter.

14. (Canceled)

15. A method for manufacturing an imaging system adapted for imaging infra-red radiation emitted by a black body, the method comprising:

providing a thermal imaging based system comprising a lens and a thermal imaging detector array, the lens being adapted to focus infra-red radiation emitted by the black body onto the thermal imaging detector array, the thermal imaging detector array having sufficient sensitivity to detect the infra-red radiation emitted by the black body, as well as infra-red radiation emitted by the lens; and

providing a shutter located between the black body and the lens, the shutter having a closed state that prevents the infra-red radiation emitted by the black body from reaching the lens while allowing the thermal imaging detector array to generate a closed state image signal comprising the infra-red radiation emitted by the lens, and an open state that allows the detector array to generate an open state image signal comprising both the infra-red radiation emitted by the lens and the infra-red radiation emitted by the black body.

16. The method of claim 15 wherein the detector array comprises a plurality of pixels for detecting the infra-red radiation; the method further comprising:

operatively coupling a signal processing module to the detector array, the signal processing module being adapted to correct open state image signals based on closed state image signals.

17 - 20. (Canceled)

21. The method of claim 16 further comprising:

operatively coupling a shutter controller to the shutter, the shutter controller adapted to command the shutter to its opened and closed states.

22. The method of claim 15 further comprising:

operatively coupling a system controller to a shutter controller and a processing module, the system controller being adapted to control operation of the imaging system.

23. The system of claim 1, wherein the shutter has a lens side surface that is located within five millimeters of a front side of the lens.

24. The system of claim 1, wherein the shutter has a lens side surface that is located within one millimeter of a front side of the lens.

## EVIDENCE APPENDIX

The following declaration under 37 CFR 1.132 was entered by the Examiner into the record on January 27, 2010 together with appellant's office action response of that date.

RULE 132 DECLARATION OF ROBERT H. MURPHY
(37 CFR 1.132)

**Qualifications:**

- Bachelors degree in Electrical Engineering (BSEE) from Northeastern University in Boston
- Former member of the Institute of Electrical and Electronic Engineers (IEEE)
- Member of SPIE (originally known as the Society of Photographic Instrumentation Engineers)
- Authored and co-authored more than a dozen technical papers in the IR imaging field.
- Awards in the infra-red imaging field:
    - BAE Systems Technical Achievement award in 1997
    - BAE Chairman's Silver Award for Innovation in 2003

I am currently a senior principle systems engineer for BAE Systems IR Imaging Systems in Lexington, Massachusetts where I began my career in 1981after receiving a Bachelor's degree in Electrical Engineering (BSEE) from Northeastern University in Boston. I have been a member of the Institute of Electrical and Electronic Engineers (IEEE), and I am currently a member of SPIE (originally known as the Society of Photographic Instrumentation Engineers) with whom I have authored and co-authored more than a dozen technical papers. I have received a number of awards for my work in the infrared imaging field, most notably the BAE Systems Technical Achievement award in 1997 and the Chairman's Silver Award for Innovation in 2003. I was jointly granted patent 5,763,885 entitled "Method and Apparatus for Thermal Gradient Stabilization of Uncooled Microbolometer Focal Plane Arrays from the US Patent Office in 1998.

**Remarks:**

This declaration is submitted so as to provide evidence regarding the conventional wisdom and thinking in the art of thermal imaging systems at the time the invention noted above was made, and regarding the state of knowledge in the art at that time regarding sources of background noise and sources of image distortion in thermal imaging systems.

The accepted wisdom in the art of thermal imaging system design at the time of the invention was to place the shutter adjacent to the detector array, also called the focal plane array, or "FPA." By this I mean that the shutter was positioned between the lens and the FPA, and not between the external scene and the lens. This was done for several practical reasons. It was common at that time for thermal imaging systems to be cryogenically cooled so as to suppress the internal flux of black body infra-red radiation emitted by components of the imaging system. The shutter was used mainly to provide calibration images that would correct for temperature variations, non-linearities, and other imperfections in the FPA itself, without regard to infra-red emissions by the lens, shutter, or other system components. There was typically room for the shutter to be located between the lens and the FPA, and placement of the shutter there allowed the shutter to be relatively small. Therefore, the conventional configuration of placing the shutter between the lens and the FPA made sense at the time.

However, at the time of the invention, thermal imaging systems were coming into use that did not employ cryogenic cooling, but instead relied on FPA temperature stabilization near room temperature, enhanced digital image correction enabled by advances in computing technology, and other system improvements and enhancements.

I do not know if infrared emissions from the lens and other internal components had ever been considered as a potential source of background noise and distortion. What I do know is that at the time of the invention, when non-cryogenically cooled systems were coming into use, it was not recognized by those of ordinary skill in the art that infra-red radiation emitted by an internal component, such as a lens, that was not

cooled could be a significant source of image distortion and noise. Instead, the accepted wisdom in the art to place the shutter between the lens and the FPA, remained generally unquestioned.

It was also not realized at that time of the invention by those of ordinary skill in the art that infra-red radiation emitted by the shutter could be a significant source of background noise and distortion, and that the effect of shutter infra-red radiation on a thermal image could not be fully corrected by acquisition of a closed shutter reference image, since the physical configuration of the shutter is necessarily different in a closed state as compared to an open state, and thus the infra-red emission of the shutter must be different in the open and closed states.

The present invention was enabled due to the discovery of these sources of background noise by the inventors. This discovery provided an impetus to proceed against the accepted wisdom of the art and place the shutter between the lens and the scene, rather than between the lens and the FPA. By placing the shutter between the lens and the scene, typically near the entry iris of the system, infra-red emissions from the lens and other internal components are included in closed-shutter reference images, thereby enabling open-shutter images to be corrected for these background noise sources.

**Summary:**

In summary, I herein declare that at the time of the invention, it was a well-established convention in the art of thermal imaging to place the shutter between the lens and the FPA. I further declare that at the time of the invention it was not generally known in the art that infra-red radiation emitted by internal components of a thermal imaging system, notably a lens, could be a significant source of background noise and distortion in a system that was not cryogenically cooled. I also declare that it was not generally known at the time of the invention that the FPA could be sensitive to a difference in infra-red emission between an open-state shutter as compared to a closed-

state shutter, and that incomplete correction of this source of background noise and distortion could thereby result.

**Affirmation**

The undersigned declares that all statements of his own knowledge made herein are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application of any patent issuing thereon.

Respectfully submitted this 27'th day of January, 2010,

Robert H Murphy

Robert H. Murphy
Senior principle systems engineer
BAE Systems Information and Electronic
Systems Integration, Inc.

## RELATED PROCEDINGS APPENDIX

There are no related procedings applicable to this appeal brief.